

Claims

1. A liquid viscosity sensor comprising an ultrasonic source, a sampling body and an ultrasonic receiver, the sampling body including a sampling face contactable by a sample of liquid, in use, the source being operable to generate a longitudinal ultrasonic wave which follows a path through the body to the sampling face and onwards to the receiver, wherein the body is configured such that the longitudinal wave emanating from the source is transformed into a horizontally polarised shear wave prior to reaching the sampling face, and the horizontally polarised shear wave is re-transformed into a longitudinal wave before reaching the receiver.
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2. A viscosity sensor as claimed in claim 1, wherein the sampling body is provided with a feature about which transformation of the waves occurs.
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3. A viscosity sensor as claimed in claim 2, wherein the feature comprises a reflection point of the body.
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4. A viscosity sensor as claimed in claim 2 or claim 3, wherein the feature comprises a reflective face of the body.
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5. A viscosity sensor as claimed in claim 4, wherein the reflective face is substantially planar.
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6. A viscosity sensor as claimed in claim 4 or claim 5, wherein the reflective face is defined by a solid to air interface of the body.
7. A viscosity sensor as claimed in any of claims 4 to 6, wherein a reflective face is positioned relative to the source such that a longitudinal wave emanating from the source and impinging upon the reflective face is reflected to produce both a reflected longitudinal wave and a reflected horizontally polarised shear wave, the shear wave being horizontally polarised with reference to the reflective face.

8. A viscosity sensor as claimed in any of claims 4 to 7, wherein the sampling face is positioned relative to the reflective face such that the shear wave emanating therefrom is vertically polarised with reference to the sampling face.

5 9. A viscosity sensor as claimed in any of claims 4 to 8, wherein the sampling face is positioned such that the shear wave emanating from the reflective face impinges upon the sampling face at a relatively shallow angle, with the result that the shear wave is reflected therefrom.

10 10. A viscosity sensor as claimed in any preceding claim, wherein the body further comprises a return reflective face to reflect the wave reflected from the sampling face.

11. A viscosity sensor as claimed in claim 10, wherein the return reflective face is arranged to reflect the shear wave back along the same path from which it was received.

15 12. A viscosity sensor as claimed in claim 10, wherein the return reflective face is arranged to reflect the shear wave along a different path from which it was received.

20 13. A viscosity sensor as claimed in any preceding claim, wherein the body comprises a material having a low acoustic impedance and low ultrasonic attenuation.

14. A viscosity sensor as claimed in claim 13, wherein the material characteristics of the body are uniform.

25 15. A viscosity sensor as claimed in claim 13 or claim 14, wherein the body comprises a plastics material.

16. A viscosity sensor as claimed in claim 15, wherein the body comprises cross-linked polystyrene.

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17. A viscosity sensor as claimed in any preceding claim, wherein the body is provided with external acoustic absorption means to absorb unwanted ultrasonic waves.

5 18. A viscosity sensor as claimed in any preceding claim, wherein the source and receiver are embodied by separate components.

19. A viscosity sensor as claimed in any of claims 1 to 17, wherein the source and receiver comprise a single component.

10 20. A method measuring the viscosity of a liquid, the method comprising the steps of:

providing a sensor comprising an ultrasonic source, a sampling body and an ultrasonic receiver, the sampling body including a sampling face,

15 placing the sampling face into contact with a liquid,

operating the source to generate a longitudinal ultrasonic wave which propagates through the body to the sampling face and onwards to the receiver,

transforming the longitudinal wave into a horizontally polarised shear wave prior to reaching the sampling face,

20 retransforming the horizontally polarised shear wave back to a longitudinal wave between the sampling face and the receiver; and

comparing the longitudinal wave received by the receiver with the longitudinal wave generated by the source to ascertain viscosity of the liquid.